



# Looking at Student Work to Focus Secondary Math Instruction

Rhonda Naylor

# Before It's Too Late



## **A Report to the Nation**

**From the *National Commission on Mathematics and Science Teaching for the 21st Century***

**After an extensive, in-depth review of what is happening in our classrooms, the Commission has concluded that the most powerful instrument for change, and therefore the place to begin, lies at the very core of education—with teaching itself.**

# Before It's Too Late



**Specific teaching skills—for example, the ability to distinguish between what is most important for students to learn and what is hardest for them to understand—can only be acquired through training, mentoring, collaboration with peers, and practice.**



# Why look at student work?

- **To make classroom decisions that support student learning, teachers must understand both the mathematics and their students, and they must continue to grow in their understanding.**
  - To have a deep understanding of mathematics.
  - To have a deep understanding of the standards.
  - To know the students well, to make instructional decisions to further their learning.

*From National Board for Professional Teaching Standards*



# Examine the Algebra Standards

- **Algebra is a language for modeling problem situations, and for reasoning and drawing inferences about functions and relations.**
- **Interplay among numerical, symbolic, verbal, and graphical representations of quantitative relationships.**
- **Processes:**
  - Discovering, describing and reasoning about patterns represented in visual, numerical, and symbolic form

# Algebra Standards



**In the vision of school mathematics, middle-grade students will learn that patterns can be represented and analyzed mathematically.**

**By the ninth grade, they will have represented linear functions with tables, graphs, verbal rules, and symbolic rules and worked with and interpreted these representations.**



# Unpacking Content Standards

## Understandings and “Big Ideas”

- Students will understand that...
- Students will be able to ...



# Algebra Standards

**In grades 9–12 all students should:**

- **Understand patterns, relations, and functions**
  - generalize patterns;
  - understand relations and functions and select, convert flexibly among, and use various representations for them;
  - analyze functions of one variable by investigating rates of change, intercepts, zeros;
- **Use mathematical models to represent and understand quantitative relationships**
  - draw reasonable conclusions about a situation being modeled;
- **Analyze change in various contexts**
  - approximate and interpret rates of change from graphical and numerical data.





# Colorado Algebra Standards

- **Students use algebraic methods to explore, model, and describe patterns and functions involving numbers, shapes, data, and graphs in problem-solving situations and communicate the reasoning used in solving these problems.**



# Colorado Algebra Standards

**In order to meet this standard, a student will**

- **identify, describe, analyze, extend, and create a wide variety of patterns in data;**
- **describe patterns using mathematical language;**
- **solve problems and model real-world situations using patterns and functions;**
- **describe the connections among representations of patterns and functions, including words, tables, graphs, and symbols.**



# The Task: Journey West

- **Complete the task**

# Architecture of Accomplished Teaching



- **Assessment of students**
  - Who are the students and what do they need?
- **Standards**
  - Set high and worthwhile goals (standards) that are appropriate for these students at this time
- **Instruction**
- **Evaluate student learning on the standards**
- **Reflect on student learning**
  - Reflect on the instruction
  - Make curricular decisions

*NBPTS*



# The Task: Journey West

- **Examine the standards in relationship to this task:**
  - What knowledge will students be demonstrating with this task?
  - What will students be able to do?
  
- **As we look at student work, what is the most important feature that would be present in upper tier papers but not in lower tier papers?**
  
- **What math language would be valued?**



# The 4 Point Rubric

## ■ 4 score points

**All answers are correct**

**1) Smith, 9-11 gallons**

**2) A. 10 day     B. 15 gallons**

**3) 140 gallons**

**Graph is correct and correctly extends the lines to form a line of best fit.**

**Strong explanation in question 1 using sophisticated math language (Identifying the rate)**

**Justifications in questions 2 and 3 are based on data from the table and/or graph and use sophisticated math language or representations.**



# The 4 point Rubric

## ■ 3 score points

**All answers are correct**

**1) Smith**

**2) A. 10 day      B. 15 gallons**

**3) 140 gallons or 130 gallons with justification**

**Graph is correct.**

**Strong explanation in question 1 using math language**

**Justifications in questions 2 and 3 are based on data from the table and/or graph.**



# The 4 point Rubric

## ■ 2 score points

**Has two parts of the questions correct**

**Graph has the table data plotted correctly but does not extend the information**

**Some justification to questions 1,2,3, to the data and graph, but not complete**





# The 4 point Rubric

## ■ 1 score point

**Has less than two questions correct  
Graph is incorrect**

**Little to no justification to questions 1,2,3, by  
using the data and the graph**



# Looking at Student Work

**What does the student know?**

**What is the student able to do?**

**What are the next steps for instruction?**

Will a note be enough?

# In Your Classroom



- Select a standard or objectives**
- Plan an instructional sequence**
- Select a performance task**
- Collaboratively examine student work**
- Reflect on what students learned**
- Reflect on instructional sequence and revise to ensure student learning**
  - Share with us electronically

# Resources



**Project Zero at Harvard Graduate School of Education**

**Annenberg Institute for School Reform at Brown University**

***Looking at Student Work For Teacher Learning, Teacher Community, and School Reform. Little, Gearhart, Curry, And Kafka, Phi Delta Kappan; Nov 2003***

# A Vision of the Future



**The star teachers of the twenty-first century will be those who work together to infuse the best ideas into standard practice.**

**They will be teachers who collaborate to build a system that has the goal of improving students' learning in the average classroom, who work to gradually improve standard classroom practice...**

**The best we know becomes the standard way of doing something.**

**The star teachers of the twenty-first century will be teachers who work every day to improve teaching--not only their own but that of the whole profession.**

*The Teaching Gap*